PATENT ABSTRACTS OF JAPAN

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(54) **MICROFIBER**

(57)Abstract:
PROBLEM TO BE SOLVED: To obtain a microfiber having a new soft feeling, high glossy feeling and wiping ability and biodegradable in soil and compost.
SOLUTION: This microfiber is a polylactic acid fiber having ≤0.5 dtex single filament fineness.

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CLAIMS

[Claim(s)]
[Claim 1] Super-thin fiber which single fiber fineness becomes from biodegradability thermoplasticity aliphatic series polyester 0.5decitex or less.
[Claim 2] Super-thin fiber according to claim 1 whose thermoplastic aliphatic series polyester is polylactic acid.
[Claim 3] The textiles containing super-thin fiber according to claim 1 or 2.
[Claim 4] The textiles according to claim 3 which are wiping crosses.
[Claim 5] The textiles according to claim 3 which are filters.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention not only has soft new aesthetic property, a high feeling of gloss, and the outstanding wiping engine performance, but relates to the super-thin fiber decomposed in soil or compost.
[0002]
[Description of the Prior Art] Super-thin fiber is used as ******** or artificial leather from the soft hand, and is used for the garments application or the interior application. Moreover, it is made the gestalt of paper or a nonwoven fabric and is used also for applications, such as a filter, the insulating paper, a wiper, a packing material, and ** material. The super-thin fiber used for these applications had to reclaim land in incineration disposal after the use, it had to dispose, and the environmental load by air pollution or neglect after reclamation was large. In recent years, the load reduction to an environment is called for from the standpoint of earth environmental preservation. However, since neither 6 nylon used for conventional super-thin fiber, nor a polyethylene tele FUTA rate, polypropylene, etc. disassembled in soil and compost, the incineration disposal or must reclaim land and dispose and according to air pollution or neglect after reclamation environmental load was large after use. The super-thin fiber decomposed in soil and compost so that an environmental load may become small is called for in the case of abandonment of the super-thin fiber after use.
[0003]
[Problem(s) to be Solved by the Invention] The purpose of this invention solves an above-mentioned trouble, and is to offer the super-thin fiber it not only has soft aesthetic property and a soft feeling of gloss, and wiping nature, but decomposed in soil and compost.
[0004]
[Means for Solving the Problem] That is, this invention is super-thin fiber which single fiber fineness becomes from the thermoplastic aliphatic series polyester which is 0.5decitex or less. In this invention, the super-thin fiber which consists of thermoplastic aliphatic series polyester must be 0.5decitex or less. 0.1decitex or less 0.3decitex or less is more preferably good preferably. If 0.5decitex is exceeded, when using for garments, software nature and tactile feeling not only worsen, but collection effectiveness, such as dust at the time of making it a wiper and a filter, worsens.
[0005] The super-thin fiber of this invention must consist of thermoplastic aliphatic series

polyester which has biodegradability. Aromatic polyester like polyethylene terephthalate, all aromatic polyester, an aliphatic series polyamide like nylon 6 or Nylon 66, aromatic polyamide, and polyolefine are not fully disassembled in soil or compost. In addition, with the biodegradability in this invention, after hydrolyzing like polylactic acid, biodegradability is called also including what is decomposed by the microorganism etc.
[0006] As thermoplastic aliphatic series polyester, the main copolymer repeatedly used as an unit element is mentioned, for example in Pori (alpha-hydroxy acid) or these like polyglycolic acid or polylactic acid. Moreover, Pori (epsilon-caprolactone) and Pori (omega-hydroxy alkanoate) like Pori (beta propiolactone) Furthermore, Polly 3-hydroxy propionate, Polly 3-hydroxy butyrate, A Polly 3-hydroxy KAPURO rate, Polly 3-hydroxy heptanoate, The copolymer of the repeat unit element which constitutes Pori (beta-hydroxy alkanoate) and these like Polly 3-hydroxy octanoate, and the repeat unit element which constitutes Polly 3-hydroxy BARIRETO and Polly 4-hydroxy butyrate is mentioned. Moreover, the polyalkylene dicarboxylate copolymer which repeats for example, a polyethylene OKISA rate, polyethylene succinate, a polyethylene horse mackerel peat, polyethylene azelate, a polybutylene OKISA rate, polybutylene succinate, a polybutylene horse mackerel peat, polybutylene sebacate, polyhexamethylene sebacate, a poly neopentyl OKISA rate, or these, and is used as an unit element as polyalkylene dicarboxylate which consists of a condensation product of a glycol and dicarboxylic acid is mentioned.
[0007] In this invention, it can also be further used from these aliphatic series polyester polymers, being able to choose two or more polymers and mixing.
[0008] In this invention, in the polymer listed upwards from points, such as resolvability in the inside of the mechanical engine performance of super-thin fiber, soil, or compost, and silk manufacture nature The copolymer which repeated a polylactic acid system polymer, and one of the polymer or these polymers of polybutylene succinate, polyethylene succinate, a polybutylene horse mackerel peat, and polybutylene sebacate, and was made into the unit, the copolymer which repeated one of the polymers or these polymers of the poly caprolactone and poly propiolactone, and was made into the unit -- or especially these blend objects are suitable.
[0009] The case where thermoplastic aliphatic series polyester is a polylactic acid system polymer is the most desirable, and, specifically, its polymer whose melting point is 80 degrees C or more among the copolymer of the copolymer of Pori (D-lactic acid), Pori (L-lactic acid), and D-lactic acid and L-lactic acid, D-lactic acid, and hydroxycarboxylic acid or the copolymer of L-lactic acid and hydroxycarboxylic acid is desirable. Here, as hydroxycarboxylic acid in the case of being the copolymer of a lactic acid and hydroxycarboxylic acid, a glycolic acid, hydroxybutyric acid, a hydroxy valeric acid, hydroxy pentanoic acid, a hydroxy caproic acid, hydroxy oenanthic acid, a hydroxy octanoic acid, etc. are mentioned.
[0010] 60,000 or more things are [about 20,000 or more / 40,000 or more] still more preferably desirable [the thermoplastic aliphatic series polyester in this invention / number average molecular weight] preferably in respect of silk manufacture nature and the physical properties of the line of thread obtained on the strength.
[0011] In this invention, wiping nature, collection effectiveness, and catabolic rate are controllable by choosing suitably the class of the aforementioned aliphatic series polyester, the copolymerization ratio of aliphatic series polyester, the mixing ratio of

aliphatic series polyester, a fiber size, and a fiber cross-section configuration. Suitably, the size of fiber is 0.5decitex or less, and is 0.1decitex or less more preferably 0.3decitex or less still more preferably.

[0012] thermoplastic aliphatic series polyester -- the need -- responding -- mean particle diameter -- a particle 100 micrometers or less -- the time of 0.1 to 5 mass %, and a polymerization -- or it can add after that. Especially the quality of the material of a particle can illustrate preferably the internal deposit system particle which made an inactive particle, phosphorus compounds, and metallic compounds, such as a dry-process silica which is not limited, has an alkyl group on silica gel (colloidal silica), a dry-process silica, the dry-process silica containing an aluminum oxide, and a particle front face, and blocked the silanol group on the front face of a particle, alumina sol (colloidal alumina), a particle alumina, particle titanium oxide, and a calcium-carbonate sol (colloidal calcium carbonate), deposit. The particle of the silica especially whose mean particle diameter is 15-70 micrometers is desirable, and spinning nature and ductility improve.

[0013] The super-thin fiber used for this invention is obtained by extracting at least 1 component of extract mold fiber, or dividing assembled-die fiber using extract mold fiber and assembled-die fiber which are super-thin fiber type-of-seasonal-prevalence fiber. Of course, although it may not be based on a compound spinning technique but spinning of the fiber of direct fine size may be carried out, since fibrosis is so difficult that fineness becomes small by the approach of starting, it is desirable to choose the manufacture approach of fiber according to an application.

[0014] As extract mold fiber, the fiber of sea island structure is used suitably. A sea component polymer has a desirable polymer with large surface tension with melt viscosity smaller than thermoplastic aliphatic series polyester and under spinning conditions. Moreover, it must differ in the solubility or resolvability over thermoplastic aliphatic series polyester, a solvent, or a decomposition agent, and must be (solubility or resolvability is larger than thermoplastic aliphatic series polyester). Moreover, it is a polymer with small compatibility with thermoplastic aliphatic series polyester, for example, they are at least one sort of polymers chosen from polymers, such as polyethylene, polystyrene, a polyethylene copolymer, and thermoplastic polyvinyl alcohol. For example, polystyrene can extract polyethylene easily by trichlene with toluene again, and hot water can remove thermoplastic polyvinyl alcohol. And super-thin fiber can be formed by extracting or decomposition removing a sea component polymer from this sea-island-structure fiber. In addition, sea-island-structure fiber may be fiber which the sea component may be divided into plurality by the island component polymer, for example, a sea component polymer and an island component polymer serve as a layer, respectively, and is in the multilayer lamination condition, and fiber from which the island component has sheath-core structure on the fiber cross section. In addition, the island component polymer may stand in a row endlessly in the direction in fiber length, or may be in the condition of discontinuity.

[0015] As assembled-die fiber, the fiber of multilayer lamination cross-section structure and the fiber of radial cladding cross-section structure are used, and compatibility is acquired compound or by carrying out blend spinning in two or more sorts of small thermoplastic aliphatic series polyester. Each polymer may stand in a row endlessly in the direction in fiber length, or may be in the condition of discontinuity. This assembled-die fiber is stream-processed, is rubbed, is divided by processing, alkali treatment, etc., and

can be made into a super-thin fiber bundle.
[0016] Once spinning raw thread is scraped off, extension is presented without scraping off and extension is performed by hot-rolling growth. usually, under a water bath with a temperature of about 50-100 degrees C -- it is -- cutting draw magnification -- it is preferably extended by the draw magnification of 0.70 times or more 0.55 or more times. When draw magnification is less than 0.55 times of cutting draw magnification, the super-thin fiber which has sufficient reinforcement is not obtained.
[0017] The obtained super-thin fiber generating fiber may perform extract or division processing with the condition of fiber, and may make it a super-thin fiber bundle, and after creating a textile, paper, and a nonwoven fabric from this fiber, super-thin fiber may be made to form.
[0018] In this invention, within limits which do not spoil the resolvability in the inside of soil, or compost, a natural fiber, a cellulose system regenerated fiber, and other fiber can be mixed, and yarn, woven knitted goods, a nonwoven fabric, etc. can also be created.
[0019] The super-thin fiber of such this invention can be used as woven knitted goods or artificial leather, can be used for a garments application or an interior application, and can be made into the gestalt of paper or a nonwoven fabric, and can be used also for applications, such as a filter, the insulating paper, a wiper, a packing material, and ** material.
[0020]
[Example] Hereafter, although an example explains this invention concretely, this invention is not limited to these examples at all. In addition, the section in an example and % are related with mass, as long as there is no notice.
[0021] [Melting point [of thermoplastic aliphatic series polyester], glass-transition-temperature, and degree-of-crystallinity] DSC (TA3000, PerkinElmer) was used, and it measured under nitrogen-gas-atmosphere mind the condition for sample [of 10mg], and programming-rate/of 10 degrees C.
[0022] [Tensile strength of fiber] JIS It asked for the reinforcement (cN/decitex) of a sample according to L-1096.
[0023] The mass W of the test piece cut down on the [eyes] 10cm square was measured with the electronic balance (METORA: AE160), and it asked for eyes (g/m2) by W/0.01.
[0024] Three test pieces are attached so that the field of the size of 4cmx4cm may be exposed to a [wiping nature] cylinder wall for a test piece, 50g of dry sand with a pure fixed grain size and standard dust 0.1g are mixed into this cylinder, a cylinder is rotated at the speed of 60rpm, and a test piece is made to pollute standard trial dust uniformly. The deposit efficiency of dust is searched for from mass change of the test piece before and behind a trial like a degree type.
Dust deposit efficiency (%) = (mass of three test pieces before the mass-trial of three test pieces after a trial) / standard trial dust mass x100 [0025] However, standard dust is JIS. What blended as follows what is decided to be 15 sorts of dusts and aerosols for industrial testing of Z8901 is used.
Material of construction Component mass ratio (%) ** ** Kanto loam 72 Seven sorts of trial dust Carbon black 23 12 sorts of trial dust Cotton linter 5 Diameter mx die length of 1mm or less of 1.5micro [0026] The sample started on the [decomposition-among soil trial] 30cm square was laid under the location with a depth of 10cm among outdoor soil, it pulled with the appearance when taking out one month, half a year, and one year after,

and a powerful change was investigated.
[0027] The sample started on the [decomposition-among compost trial] 30cm square was laid under the location with a depth of 10cm among the compost of compost, it pulled with the appearance when taking out one month, half a year, and one year after, and a powerful change was investigated.
[0028] The sea-island composite fiber (sea island ratio 5:5) of 28 islands which used for the island component the polylactic acid (1% of D objects, number average molecular weight 90,000, melting point of 171 degrees C, glass transition temperature of 61 degrees C) obtained by carrying out ring opening polymerization of the example 1 lactide, and used polystyrene (Asahi Chemical: Styron) for the sea component was obtained by the melt spinning of the spinning temperature of 250 degrees C, and spinning rate 1000 m/min, dry heat stretching of this was increased 3 times at 120 degrees C, and the extension yarn of 167decitex / 24 filament was obtained. The super-thin fiber which knits this with a cylinder weave machine, makes it the ground, carries out elution removal of the sea component in sea island compound spinning fiber in toluene, and consists of polylactic acid was obtained. The average size (it asks by dividing the total cross section of the super-thin fiber which exists in one fiber bundle by the number) of super-thin fiber was 0.12decitex, and was what has soft new aesthetic property and was excellent also in the wiping engine performance (dust deposit efficiency is high) (Table 1). Moreover, the physical properties of super-thin fiber on the strength are on-the-strength 3.6 cN/dtex and 25.6% of ductility, and were excellent also in physical properties on the strength. What furthermore dyed this super-thin fiber by the disperse dye (Sumitomo Chemical: SumikaronBlue E-RPD 15%omf, 100 degree-Cx 40 minutes) was what has the outstanding color enhancement and has a feeling of gloss.
[0029] The polylactic acid used in the example of comparison 1 example 1 was obtained by the melt spinning of the spinning temperature of 250 degrees C, and spinning rate 1000 m/min, dry heat stretching of this was increased 3 times at 120 degrees C, and the extension yarn which consists of polylactic acid with 267decitex / 12 filament and a single fiber fineness of 22decitex was obtained. Although this was made into knitting fabric with the cylinder weave machine like the example 1, aesthetic property was hard and unsuitable to garments. moreover -- this -- the engine performance was inadequate, although it knit and wiping nature was investigated using **** (Table 1). (dust deposit efficiency is low) Physical properties on the strength are on-the-strength 4.2 cN/dtex and 19.8% of ductility, and were excellent in physical properties on the strength.
[0030]
[Table 1]

	ワイピング性 付着量(%)	風 合
実施例1	47	柔らかい
比較例1	5	硬い
実施例3	39	柔らかい

[0031] Polylactic acid obtained by carrying out ring opening polymerization of the example 2 lactide (2% of D objects, number average molecular weight 70,000, and the melting point of 161 degrees C) The sea-island composite fiber (sea island ratio 5:5) of 16 islands which used the glass transition temperature of 59 degrees C for the island

component, and used ethylene 10 mol % denaturation polyvinyl alcohol (polymerization degree 330, a saponification degree 98.4, melting point of 206 degrees C) for the sea component The spinning temperature of 230 degrees C, It obtained by the melt spinning of spinning rate 1000 m/min, and dry heat stretching of this was increased 3 times at 120 degrees C, and the extension yarn of 167decitex / 24 filament was obtained. The super-thin fiber which knits this with a cylinder weave machine, makes it the ground, carries out elution removal of the sea component in sea island compound spinning fiber in 98-degree C hot water, and consists of polylactic acid was obtained. The average size of super-thin fiber has soft aesthetic property by 0.22decitex, and a feeling of gloss also had it. Moreover, the physical properties of super-thin fiber are on-the-strength 3.4 cN/dtex and 30.6% of ductility, and were excellent. The cylinder weave ground which furthermore consists of this super-thin fiber was laid under the soil, it took out one month, half a year, and one year after, and a gestalt and physical properties on the strength were investigated. Although taken out one year after, the gestalt was falling to about 60%, when the crack has produced change and physical properties on the strength were investigated, and decomposition in soil was advancing (Table 2). Moreover, super-thin fiber was laid under the compost in compost, it took out one month, half a year, and one year after, and a gestalt and physical properties on the strength were investigated. Although taken out one year after, the gestalt had collapsed, and decomposition in compost was advancing (Table 2).

[0032]

[Table 2]

	埋設前	土壌						コンポスト					
		1ヶ月後		半年後		1年後		1ヶ月後		半年後		1年後	
	強度	形態	強度	形態	強度	形態	強度	形態	強度	形態	強度	形態	強度
実施例2	3.4	変化無し	3.1	ひび割れ	2.3	亀裂	2.0	ひび割れ	2.8	亀裂	1.9	崩壊	0
比較例2	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.0	変化無し	4.0
比較例3	3.6	変化無し	3.2	変化無し	3.5	変化無し	3.4	変化無し	3.4	変化無し	3.3	変化無し	2.9
実施例3	3.3	変化無し	2.7	ひび割れ	2.0	亀裂	1.5	ひび割れ	1.9	亀裂	1.2	崩壊	0

[0033] The super-thin fiber which consists of nylon 6 like an example 1 was obtained except having used nylon 6 (Ube Industries: UBE nylon 1011) instead of the polylactic acid used in the example of comparison 2 example 1, and having carried out spinning at 280 degrees C. although the obtained super-thin fiber was laid underground into soil and compost like the example 2 and a gestalt and physical properties were investigated -- a gestalt and physical properties -- most -- change was not accepted (Table 2).

[0034] The super-thin fiber which consists of polyethylene terephthalate like an example 1 was obtained except having used polyethylene terephthalate (Kuraray: KURAPETTO SV 845) instead of the polylactic acid used in the example of comparison 3 example 1, and having carried out spinning at 290 degrees C. although the obtained super-thin fiber was laid underground into soil and compost like the example 2 and a gestalt and physical properties were investigated -- a gestalt and physical properties -- most -- change was not accepted (Table 2).

[0035] Spinning of the assembled-die bicomponent fiber with which polylactic acid had polybutylene SAKUSHINATO (Showa High Polymer: PBS; Bionolle # 1000) to the

polylactic acid used in the example 3 example 2 at a mass rate of 1:1, and six layers and PBS had lamination structure of five layers, respectively was carried out at 220 degrees C, and the cylinder weave ground was obtained like the example 2. Subsequently, fiber split processing of the assembled-die fiber of the cylinder weave ground was carried out in 80 degree-Cx 40 minutes among 0.2% sodium-hydroxide water solution using the small pot dyeing machine (capacity of 300 cc), and the super-thin fiber bundle was made to discover. The average size of the super-thin fiber which consists of polylactic acid and PBS was 0.33decitex. The obtained super-thin fiber was what there is also a feeling of gloss and it not only has and carries out soft new aesthetic property, but has sufficient physical properties on the strength (Table 2). Moreover, it consisted of this super-thin fiber, and knit, and the ground was excellent also in the wiping engine performance (Table 1). When this super-thin fiber was furthermore laid underground into soil and compost like the example 2 and a gestalt and physical properties were investigated, decomposition was advancing like the example 2 (Table 2).

[0036]

[Effect of the Invention] It not only has soft new aesthetic property, a high feeling of gloss, and wiping nature, but it can offer the super-thin fiber decomposed in soil and compost.

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審査請求　未請求　請求項の数５　ＯＬ　（全５頁）

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Ｆターム(参考)　３Ｂ０７４ ＡＡ０２ ＡＡ０４ ＡＡ０８ ＡＢ０１
４Ｄ０１９ ＢＢ０３ ＢＢ０５
４Ｌ０３５ ＢＢ３２ ＢＢ８９ ＢＢ９１ ＤＤ０１ ＥＥ１３
ＥＥ２０ ＦＦ０１
４Ｌ０４１ ＡＡ０７ ＡＡ２０ ＢＡ０４ ＢＡ０５ ＢＡ１６
ＢＣ２０ ＢＥ０６ ＢＤ１４ ＢＤ２０ ＣＡ０５
ＣＡ４４ ＣＡ４７ ＤＤ０１ ＤＤ１１ ＤＤ１４
ＥＥ０６ ＥＥ１４ ＥＥ１６

(54)【発明の名称】　極細繊維

(57)【要約】
【課題】　柔らかい新規な風合いと高い光沢感、ワイピング性を有するだけでなく、土壌中やコンポスト中で分解する極細繊維を提供する。
【解決手段】　単繊維繊度が０．５デシテックス以下であるポリ乳酸極細繊維。

1

【特許請求の範囲】

【請求項１】　単繊維繊度が０．５デシテックス以下の生分解性熱可塑性脂肪族ポリエステルからなる極細繊維。

【請求項２】　熱可塑性脂肪族ポリエステルがポリ乳酸である請求項１記載の極細繊維。

【請求項３】　請求項１又は２に記載の極細繊維を含む繊維製品。

【請求項４】　ワイピングクロスである請求項３に記載の繊維製品。

【請求項５】　フィルターである請求項３に記載の繊維製品。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は柔らかい新規な風合い、高い光沢感、優れたワイピング性能を有するだけでなく、土壌中あるいはコンポスト中で分解する極細繊維に関するものである。

【０００２】

【従来の技術】極細繊維は、その柔らかい風合から縫製品や人工皮革にして衣料用途やインテリア用途に用いられている。また、紙や不織布の形態にして、フィルター、絶縁紙、ワイパー、包装材、衛材等の用途にも用いられている。これらの用途に用いられた極細繊維はその使用後、焼却処分か埋め立て処分しなければならず、大気汚染や埋め立て後放置による環境負荷は大きいものであった。近年、地球環境保全の見地から環境に対する負荷低減が求められている。しかしながら従来の極細繊維に用いられている６ナイロンやポリエチレンテレフタレート、ポリプロピレン等は土中やコンポスト中で分解しないために、使用後、焼却処分か埋め立て処分しなければならず、大気汚染や埋め立て後放置による環境負荷は大きいものであった。使用後の極細繊維の廃棄の際、環境負荷が小さくなるように土壌中やコンポスト中で分解する極細繊維が求められている。

【０００３】

【発明が解決しようとする課題】本発明の目的は、上述の問題点を解決するものであり、柔らかい風合いや光沢感、ワイピング性を有するだけでなく、土壌中やコンポスト中で分解する極細繊維を提供することにある。

2

率も高くなる。

【０００５】本発明の極細繊維は生分解性を有する熱可塑性脂肪族ポリエステルから構成されていなければならない。ポリエチレンテレフタレートのような芳香族ポリエステル、全芳香族ポリエステル、ナイロン６やナイロン６６のような脂肪族ポリアミド、芳香族ポリアミド、ポリオレフィンは土壌中あるいはコンポスト中で十分に分解しない。なお、本発明における生分解性とは、例えば、ポリ乳酸のように加水分解された後に微生物等により分解されるものも含めて生分解性と称する。

【０００６】熱可塑性脂肪族ポリエステルとしては、例えばポリグリコール酸やポリ乳酸のようなポリ（α－ヒドロキシ酸）またはこれらを主たる繰り返し単位要素とする共重合体が挙げられる。また、ポリ（ε－カプロラクトン）、ポリ（β－プロピオラクトン）のようなポリ（ω－ヒドロキシアルカノエート）が、さらに、ポリ－３－ヒドロキシプロピオネート、ポリ－３－ヒドロキシブチレート、ポリ－３－ヒドロキシカプロレート、ポリ－３－ヒドロキシヘプタノエート、ポリ－３－ヒドロキシオクタノエートのようなポリ（β－ヒドロキシアルカノエート）およびこれらを構成する繰り返し単位要素とポリ－３－ヒドロキシバリレートやポリ－４－ヒドロキシブチレートを構成する繰り返し単位要素との共重合体が挙げられる。また、グリコールとジカルボン酸の縮合体からなるポリアルキレンジカルボキシレートとして、例えば、ポリエチレンオキサレート、ポリエチレンサクシネート、ポリエチレンアジペート、ポリエチレンアゼレート、ポリブチレンオキサレート、ポリブチレンサクシネート、ポリブチレンアジペート、ポリブチレンセバケート、ポリヘキサメチレンセバケート、ポリネオペンチルオキサレートまたはこれらを繰り返し単位要素とするポリアルキレンジカルボキシレート共重合体が挙げられる。

【０００７】本発明において、さらにこれらの脂肪族ポリエステルポリマーから複数のポリマーを選択し、混合して使用することもできる。

【０００８】本発明においては、極細繊維の機械的性能、土中あるいはコンポスト中での分解性および製糸性等の点から、上に列記したポリマーの中で、ポリ乳酸系重合体と、ポリブチレンサクシネート　ポリエチレンサ

ボン酸との共重合体あるいはＬ－乳酸とヒドロキシカルボン酸との共重合体のうち、融点が８０℃以上である重合体が好ましい。ここで、乳酸とヒドロキシカルボン酸との共重合体である場合におけるヒドロキシカルボン酸としては、グリコール酸、ヒドロキシ酪酸、ヒドロキシ吉草酸、ヒドロキシペンタン酸、ヒドロキシカプロン酸、ヒドロキシヘプタン酸、ヒドロキシオクタン酸等が挙げられる。

【００１０】本発明における熱可塑性脂肪族ポリエステルは、数平均分子量が約２０，０００以上、好ましくは４０，０００以上、さらに好ましくは６０，０００以上のものが、製糸性および得られる糸条の強度物性の点で好ましい。

【００１１】本発明においては、前記の脂肪族ポリエステルの種類、脂肪族ポリエステルの共重合比、脂肪族ポリエステルの混合比、繊維太さ、繊維横断面形状を適宜選択することによって、ワイピング性、捕集効率、分解速度を制御することができる。好適には、繊維の太さは０．５デシテックス以下であり、さらに好ましくは０．３デシテックス以下、より好ましくは０．１デシテックス以下である。

【００１２】熱可塑性脂肪族ポリエステルには必要に応じて平均粒子径が１００μｍ以下の微粒子を０．１～５質量％、重合時又はその後に添加することができる。微粒子の材質は特に限定されず、たとえばシリカゲル（コロイダルシリカ）、乾式法シリカ、酸化アルミニウムを含有する乾式法シリカ、粒子表面にアルキル基を有し、かつ粒子表面のシラノール基を封鎖した乾式法シリカ、アルミナゾル（コロイダルアルミナ）、微粒子アルミナ、微粒子酸化チタン、炭酸カルシウムゾル（コロイダル炭酸カルシウム）などの不活性微粒子やリン化合物と金属化合物とを析出せしめた内部析出系微粒子等を好ましく例示できる。特に平均粒子径が１５～７０μｍのシリカの微粒子が好ましく、紡糸性や延伸性が向上する。

【００１３】本発明に用いる極細繊維は、極細繊維発生型繊維である抽出型繊維や分割型繊維を用いて、抽出型繊維の少なくとも１成分を抽出するか、分割型繊維を分割することにより得られる。もちろん、複合紡糸技術によらず、直接細繊度の繊維を紡糸してもよいが、かかる方法では、繊度が小さくなるほど繊維化が困難であるの

あり、例えば、ポリエチレン、ポリスチレン、共重合ポリエチレン、熱可塑性ポリビニルアルコールなどのポリマーから選ばれた少なくとも１種のポリマーである。例えばポリスチレンはトルエンにより、またポリエチレンはトリクレンにより容易に抽出可能であり、また熱可塑性ポリビニルアルコールは熱水により除去可能である。そしてこの海島構造繊維から海成分ポリマーを抽出又は分解除去することにより極細繊維を形成することができる。なお海島構造繊維とは、繊維横断面において、海成分が島成分ポリマーにより複数個に分割されていてもよく、例えば海成分ポリマーと島成分ポリマーとがそれぞれ層となり、多層貼り合わせ状態となっているような繊維や島成分が芯鞘構造になっている繊維であってもよい。なお島成分ポリマーは繊維長さ方向にエンドレスで連なっていても、あるいは不連続の状態であってもよい。

【００１５】分割型繊維としては多層貼合せ断面構造の繊維や放射状張合せ断面構造の繊維が用いられ、相溶性が小さい２種以上の熱可塑性脂肪族ポリエステルを複合または混合紡糸することにより得られる。それぞれのポリマーは繊維長さ方向にエンドレスで連なっていても、あるいは不連続の状態であってもよい。この分割型繊維は水流処理、揉み処理、アルカリ処理等によって分割され、極細繊維束にすることができる。

【００１６】紡糸原糸は、一旦巻取られた後、または巻取ることなく延伸に供され、延伸は熱延伸にて行われる。通常５０～１００℃程度の温度の水浴中で切断延伸倍率の０．５５倍以上、好ましくは０．７０倍以上の延伸倍率で延伸される。延伸倍率が切断延伸倍率の０．５５倍未満の場合、十分な強度を有する極細繊維が得られない。

【００１７】得られた極細繊維発生繊維は繊維の状態のままで抽出又は分割処理を施して極細繊維束にしてもよいし、該繊維から布帛、紙、不織布を作成した後に極細繊維を形成させてもよい。

【００１８】本発明においては、土壌中あるいはコンポストでの分解性を損なわない範囲内で、天然繊維やセルロース系再生繊維、その他の繊維を混合して糸、繊編物、不織布等を作成することもできる。

【００１９】このような本発明の極細繊維は、繊編物や

ラス転移温度．結晶化度］ＤＳＣ（ＴＡ３０００．パーキンエルマー）を使用し．試料１０ｍｇ、昇温速度１０℃／分の条件で窒素雰囲気下で測定した。

【００２２】［繊維の引張強度］ＪＩＳ Ｌ－１０９６に準じて、試料の強度（ｃＮ／デシテックス）を求めた。

【００２３】［目付］１０ｃｍ角に切り出した試験片の質量Ｗを電子天秤（メトラー社：ＡＥ１６０）で測定し．Ｗ／０．０１により目付（ｇ／ｍ²）を求めた。

【００２４】［ワイピング性］円筒内壁に試験片が４ｃｍｘ４ｃｍの広さの面が露出するように試験片を３枚取＊

＊り付け、この円筒中に一定粒度の清浄な乾燥砂５０ｇと標準ダスト０．１ｇを投入して、６０ｒｐｍのスピードで円筒を回転させ、標準試験ダストを一様に試験片に汚染させる。次式のように試験前後の試験片の質量変化よりダストの付着率を求める。

ダスト付着率（％）＝（試験後の試験片３枚の質量－試験前の試験片３枚の質量）／標準試験ダスト質量ｘ１００

【００２５】ただし、標準ダストはＪＩＳ ２８９０１の試験用ダスト１５種に決められているものを以下のように配合したものを用いる。

使用材料	成分質量比（％）	備　考
関東ローム	７２	試験ダスト７種
カーボンブラック	２３	試験ダスト１２種
コットンリンター	５	直径１．５μｍｘ長さ１ｍｍ以下

で編地にしたが．風合いが硬く、衣料用には不適なものであった。またこの編み地をを用いてワイピング性を調べたが、性能は不十分なもの（ダスト付着率が低い）であった（表１）。強度物性は、強度４．２ｃＮ／dtex、伸度１９．８％であり、強度物性には優れたものであった。

【００２６】［土壌中分解試験］３０ｃｍ角に切り出した試料を屋外の土壌中、深さ１０ｃｍの位置に埋設し、１ヶ月後、半年後、１年後に取り出したときの外観と引張り強力の変化を調べた。

【００２７】［コンポスト中分解試験］３０ｃｍ角に切り出した試料をコンポストの堆肥中．深さ１０ｃｍの位置に埋設し、１ヶ月後、半年後、１年後に取り出したときの外観と引張り強力の変化を調べた。

【００２８】実施例１

ラクチドを開環重合して得られたポリ乳酸（Ｄ体１％、数平均分子量９０，０００．融点１７１℃、ガラス転移温度６１℃）を島成分に．ポリスチレン（旭化成：スタイロン）を海成分に用いた２８島の海島複合繊維（海島比５：５）を紡糸温度２５０℃、紡糸速度１０００ｍ／ｍｉｎの溶融紡糸により得．これを１２０℃で３倍に乾熱延伸し、１６７デシテックス／２４フィラメントの延伸糸を得た。これを筒編み機で編み地にし、トルエン中で海島複合紡糸繊維中の海成分を溶出除去してポリ乳酸からなる極細繊維を得た。極細繊維の平均繊度（１本の繊維束に存在する極細繊維の全断面積を本数で割ることにより求める）は０．１２デシテックスであり．柔らかく新規な風合いを有するものであり．またワイピング性能も優れたもの（ダスト付着率が高い）であった（表１）。また極細繊維の強度物性は、強度３．６ｃＮ／dtex．伸度２５．６％であり．強度物性にも優れたもので

【００３０】

【表１】

	ワイピング性付着量(g)	風　合
実施例１	４７	柔らかい
比較例１	５	硬い
実施例３	３８	柔らかい

【００３１】実施例２

ラクチドを開環重合して得られたポリ乳酸（Ｄ体２％、数平均分子量７０，０００．融点１６１℃、ガラス転移温度５９℃）を島成分に．エチレン１０モル％変性ポリビニルアルコール（重合度３３０、鹸化度９８．４、融点２０６℃）を海成分に用いた１６島の海島複合繊維（海島比５：５）を紡糸温度２３０℃．紡糸速度１０００ｍ／ｍｉｎの溶融紡糸により得、これを１２０℃で３倍に乾熱延伸し．１６７デシテックス／２４フィラメントの延伸糸を得た。これを筒編み機で編み地にし．９８℃の熱水中で海島複合紡糸繊維中の海成分を溶出除去し

埋設し、１ヶ月後、半年後．１年後に取り出して形態と強度物性を調べた。１年後に取り出したものの形態は崩壊しており、コンポスト中での分解が進行していた（表＊２）。

【００３２】

【表２】

	埋設前	土壌						コンポスト					
		１ヶ月後		半年後		１年後		１ヶ月後		半年後		１年後	
	強度	形態	強度	形態	強度	形態	強度	形態	強度	形態	強度	形態	強度
実施例２	3.4	変化無し	3.1	ひび割れ	2.3	亀裂	2.0	ひび割れ	2.8	亀裂	1.9	崩壊	0
比較例２	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.1	変化無し	4.0	変化無し	4.0
比較例３	3.6	変化無し	3.8	変化無し	3.5	変化無し	3.4	変化無し	3.4	変化無し	3.8	変化無し	2.9
実施例３	3.8	変化無し	2.7	ひび割れ	2.0	亀裂	1.5	ひび割れ	1.9	亀裂	1.2	崩壊	0

【００３３】比較例２

実施例１で用いたポリ乳酸の代りにナイロン６（宇部興産：ＵＢＥナイロン１０１１）を用いて２８０℃で紡糸したこと以外は実施例１と同様にしてナイロン６からなる極細繊維を得た。得られた極細繊維を実施例２と同様に土壌中およびコンポスト中に埋設して形態と物性を調べたが、形態．物性ともに殆ど変化が認められなかった（表２）。

【００３４】比較例３

実施例１で用いたポリ乳酸の代りにポリエチレンテレフタレート（クラレ：クラベットＳＶ８４５）を用いて２９０℃で紡糸したこと以外は実施例１と同様にしてポリエチレンテレフタレートからなる極細繊維を得た。得られた極細繊維を実施例２と同様に土壌中およびコンポスト中に埋設して形態と物性を調べたが．形態、物性ともに殆ど変化が認められなかった（表２）。

【００３５】実施例３

実施例２で用いたポリ乳酸とポリブチレンサクシナート（ＰＢＳ：昭和高分子：ビオノーレ＃１０００）をそれぞれ１：１の質量割合でポリ乳酸が６層、ＰＢＳが５層の貼合わせ構造をした分割型複合繊維を２２０℃で紡糸し．実施例２と同様にして筒編み地を得た。ついで小型のポット染色機（容量３００ｃｃ）を用いて筒編み地の分割型繊維を０．２％水酸化ナトリウム水溶液中．８０℃×４０分で割繊処理して極細繊維束を発現させた。ポリ乳酸とＰＢＳとからなる極細繊維の平均繊度は０．３３デシテックスであった。得られた極細繊維は．柔らかく新規な風合いを有しするばかりでなく、光沢感もあり．また十分な強度物性を有するものであった（表２）。またこの極細繊維からなる編み地はワイピング性能にも優れたものであった（表１）。さらにこの極細繊維を実施例２と同様に土壌中およびコンポスト中に埋設して形態と物性を調べると．実施例２と同様に分解が進行していた（表２）。

【００３６】

【発明の効果】柔らかい新規な風合いと高い光沢感、ワイピング性を有するだけでなく、土壌中やコンポスト中で分解する極細繊維を提供できる。